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Chapter 2

ASSESSING SELF-REGULATED LEARNING AND ITS RELATION TO COGNITIVE PERFORMANCE IN EARLY CHILDHOOD EDUCATION

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ABSTRACT

Assessment of cognitive skills and metacognitive self-regulated learning strategies is important in order to discover students' level of cognitive processing, and be able to intervene through the teaching process to mitigate any existing problems. The objective of this study was to assess the use of metacognitive, cognitive and motor strategies on a given task. A total of 68 five-year-old pupils enrolled in Early Childhood Education participated in the study. The assessment was carried out with an *ad-hoc* instrument based on the think-aloud technique, and having adequate reliability and validity values. Descriptive, associative and inferential analyses were performed. The results showed greater use of cognitive and motor strategies than of metacognitive strategies. A significant association was also found between the use of strategies at

each moment of the task and final performance. Implications are discussed for the teaching of cognitive skills and meta-skills during this stage of education.

Keywords: Early childhood education, self-regulated learning, metacognitive strategies, performance, assessment of cognitive processes

INTRODUCTION

Learning today means constructing knowledge. In the case of scholastic learning, the knowledge to be learned is intentionally determined in advance. This construction process, in turn, necessarily requires the mental activity of the pupil, who ultimately gives sense and significance to what is learned. Therefore, we turn from the idea of learning as merely the accumulation of things known; instead, learning is conceived as the subject's continuous modification of his or her own knowledge schemata. Involved in this process is the use of metacognitive skills that enable one's personal control over one's own knowledge and learning processes.

Explanatory Models of Self-Regulated Learning

To Zimmerman we owe the appearance of *self-regulated learning* as a concept, as well as the initial research that sought to identify and understand self-direction processes in acquiring knowledge (Bembenutty, Cleary, & Kitsantas, 2013: de la Fuente & Eissa, 2010; Zimmerman, 1986, 1990; Zimmerman, & Labuhn 2012; Zimmerman & Schunk, 1989). This perspective originates from metacognitive research and holds important implications. Some examples include: considering students as active participants from the metacognitive point of view, and factors that influence students' decisions on how and why they decide to use a certain strategy (González, Escoriza, González & Barca, 1996).

The Pintrich model (2000) is to be noted as one of the most important attempts to synthesize the different processes and activities that help increase self-regulation while learning (Torrano & González, 2004). It is based on a socio-cognitive perspective and organizes the different regulatory processes into four phases: forethought, self-monitoring, control and reflection. Within each phase we find four areas: the cognitive, motivational-affective,

behavioral and contextual. All these phases and areas interact with each other, and are activated also in relation to the demands of the task.

Finally, the DEDEPRO Model (De la Fuente & Justicia, 2007), a further development from a previous model (De la Fuente & Martínez, 2000), attempts to synthesize the former two: the Justicia and Cano (1996) model and the Pintrich (2000) model. From the former he primarily draws the typology of strategies, while, based on contributions from the latter, he adopts a line of three major moments at which students apply their strategies in self-regulated fashion: before, during and after the task (Martínez & De la Fuente, 2004):

- At the *first moment (before),* the student is to become aware of and plan the activity that is to be performed. Awareness requires, at a minimum, reflection on the characteristics of the task, one's personal way of learning, and the particularities of the cognitive process and strategy used. These three elements are similar to those alluded to above, when speaking of metacognitive strategies (Flavell, 1987).Forethought will guide the rest of the task performance process. At this point it is important for the student to reflect on the objectives of the task, and to set learning goals.
- The *second moment (during)* involves knowing what to do, how to do it, when and where to do it, while carrying out the learning process. The objective is for the student to be able to regulate himself or herself at this phase of execution. For this purpose, aside from cognitive activity, thought should also be given to maintaining one's motivation.
- At the *third moment (after)* the student should carry out an evaluation of the entire process followed until that point. This phase is the time to reflect on what has been learned and on aspects that should be improved in similar situations that may be encountered later.

The PRO-REGULA program (De la Fuente & Martínez, 2000) is a tool based on this model, designed to work on self-regulation by incorporating it into the stage of Primary Education. The empirical study that we present here is also based on this model.

Self-Regulation Strategies in Early Childhood Education

There is clear evidence of a correlation between self-regulation at an early age, and self-regulation throughout the school years and the individual's life (Eisenberg et al., 1996, 1997). In this line, Flavell (1977) emphasizes the importance of self-regulated learning in Early Childhood Education, affirming that its significant growth during this period constitutes a key point of inflection for the child's development. Recently, other authors have reached research conclusions that self-regulation strategies do exist in preschoolers (Sperling, Walls & Hill, 2000). Along the same line, studies from Das, Kar and Parrilla (1998) on the child's capacity for planning (understood as regulation of cognitive processes), attribute a true planning ability to children at the age of five.

One of the fundamental reasons for the relative lack of interest in this stage of education, despite the evidence described above, is the concept of the child in Early Childhood Education as a *"pre"*, someone who is not yet able to learn complex aspects, and therefore, is not able to make strategic use of procedures, since they have not yet been fully mastered (Olerón, 1987). However, as Monereo (2001) explains, this opinion is not only mistaken, but it establishes an unadvisable separation between mastery of a procedure and its strategic use.

As for the research panorama of Self-Regulated Learning in Early Childhood Education, perhaps the best known researcher is Pramling (1988, 1990, 1993). This author explored children's conceptions of learning from a phenomenological approach, considering their perceptions to be an expression of the different levels of metacognitive awareness. Her work, carried out through semi-structured individual interviews, includes both the referential aspect of learning *(what)* and the structural aspect *(how)* (Marton, 1988). Her primary conclusions are presented below (adapted by Ayala & Martín, 1997):

- Regarding small children's conceptions of *what they are learning,* children pass through three successive phases, the first of which begins in the first weeks of preschool:
  - Learning always involves *knowing how to do* something new, whether new manual skills (cutting things out) or intellectual (counting). (around age three)
  - Learning involves new *knowledge* about the world.
  - Learning involves *understanding* reality.

- Regarding children's conception of *how they learn,* we may also distinguish three phases:
  - No distinction between *doing* and *learning to do.*
  - Learning as a consequence of *maturing,* of "getting big".
  - Learning as a result of *experience.*

One important contribution from Pramling was categorizing conceptions about preschoolers' learning as deep and surface, as a function of their ability to become aware of their own learning and transfer a specific thing learned to other situations. Finally, Pramling is also attributed the intervention design of discovering conceptions using *metacognitive dialogue.* This method, roughly speaking, seeks reflection on daily situations in order to transform children's conceptions about learning at three levels: content, structure and learning itself.

Objectives and Hypotheses

One reason that justifies realization of this research is the scarcity of knowledge and instruments currently available on self-regulated learning for children under the age of six, in stark contrast to the importance that this topic has acquired at other levels of education. Specifically, we have two fundamental *objectives.* First, to describe the self-regulation strategies used by five-year-olds while executing a specific task. Second, to establish association relationships between the strategies used, and between these strategies and task performance. From these study objectives, the following *hypotheses* were formulated:

Hypothesis 1. Observed frequency of use of the strategies assessed will be low.
Hypothesis 2. In the case of metacognitive strategies, the frequency will be even lower, since they have not been worked on as much at school.
Hypothesis 3. There will be significant association relationships among the total strategies used at different moments.
Hypothesis 4. There will be significant association relationships between the total strategies used at the three moments, and performance.
Hypothesis 5. There will be significant association relationships between the total metacognitive strategies and performance.

METHOD

Participants

A total of 68 subjects participated, all of them in the final year of Early Childhood Education (5- and 6-year-olds), at a public school in Spain. The school was selected through a non-probabilistic procedure, as a function of available access, and subjects included all the pupils from the three class groups of this grade level in the school, except for two pupils who had to be eliminated from the sample due to excess reactivity, and who could not be successfully led through the research protocol. There were 36 girls and 32 boys. As for place of birth, there were six foreign pupils (3 Moroccans, 2 Ecuadorians, and 1 Ghanaian), all of them with full mastery of the language, and most of them enrolled in the same school from earlier grades (*T.N.* Spanish public school begins at age 3.) No child had been diagnosed with special educational needs.

A pilot run, for the purpose of training the assessors, used a sample of 6 pupils from the same school, but at different grade levels (ECE 4-year-olds and 1st grade of Primary) and 10 five-year-olds from another school, located in downtown Almeria (Spain). They were selected based on ease of access to their respective classrooms, and being considered mainly average-level pupils, with a few low and high cases, according to their mainstream teachers.

Instruments

The instrument used for this study is a protocol which is both a guide and a register (log) for assessment based on a specific task. This protocol is structured along three points in time (before, during and after), and exemplifies the *think-aloud* technique (Meichembaum et al., 1985) as a variation on the interview. The instrument is described in Appendix 1. The variables measured directly through the *student protocol* correspond to strategies that the children use while resolving the task. These strategies, summarized in Appendix 1 as a function of their type and moment of use, are as follows:

1. *Awareness.* The child's response when asked what he or she considers to be most important about the task, and what others expect them to learn from it, according to protocol instructions as shown in Appendix

1. This variable, in turn, consists of four non-exclusive response levels: Level 1 (I don't know, says nothing, extraneous aspects, etc.), Level 2 (motor aspects), Level 3 (metacognitive aspects) and Level 4 (central aspects). This is considered to be a first-moment strategy (before).

2. *Planning.* Verbalizations that the child makes about his or her thoughts before performing the task, which may represent a guide for how it is to be done. This variable consists of two response levels, according to whether such verbalizations are observed or not.
3. *Cognitive metacognition.* The child's verbalizations about his or her thoughts. This variable does not have response options, the observers recorded its appearance when seen. This is considered to be a second-moment strategy (during).
4. *Motor metacognition.* The child's verbalizations about his or her motor actions. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
5. *Support metacognition.* The child's verbalizations that imply certain control over his or her affective-motivational processes. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
6. *Prior organization.* The child's verbalizations in anticipation of his or her immediate actions. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
7. *Explicit review.* The child's verbalizations that allude to use of this strategy. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
8. *Counting.* In this strategy, the observers recorded evidence from their observation of how the cognitive operation of counting was performed. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
9. *Comparing.* Evidence was recorded from observing active indication of the cognitive operation of comparing one drawing to another. This variable does not have response options, the assessors recorded its

appearance when observed. This is considered to be a second-moment strategy (during).

10. *Information seeking (asking).* The child's verbalizations in the form of asking task-related questions of the researchers. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
11. *Reviewing.* Evidence was recorded from observing how the child assessed the task or some part of it. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
12. *Attitudes and feelings.* The child's verbalizations alluding to his or her affective states, both positive and negative. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
13. *Self-stimulation.* The child's verbalizations for self-encouragement. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
14. *Drawing.* Evidence from observing the action of drawing. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
15. *Coloring.* Evidence from observing the action of coloring. This variable does not have response options, the assessors recorded its appearance when observed. This is considered to be a second-moment strategy (during).
16. *Self-assessment.* The child's response when asked about the results of his or her execution, according to protocol instructions in Appendix 1. This variable in turn consists of three response levels: good, so-so or bad. This is considered to be a third-moment strategy (after).
17. *Justification.* The child's response when asked about the reasons for his or her self-assessment, according to protocol instructions in Appendix 1. This variable in turn consists of three non-exclusive response levels: justification based on the real objective of the task, allusions to metacognitive aspects and justification based on motor aspects. This is considered to be a third-moment strategy (after).
18. *Ways to improve.* The child's responses when asked about the changes he or she would make in a hypothetical later situation, according to protocol instructions shown in Appendix 1. This variable in turn

consists of the same three response levels given in the previous case. This is considered to be a third-moment strategy (after).

Afterward, subtotals were calculated in reference to each typology and to each moment of strategy use, as well as a grand total.

Variables measured directly (nominal type) were converted to scalar measurements, which are more operational for carrying out appropriate statistical analyses. This operation was carried out either based on the design of a scale by degrees (in the case of the awareness variables, or of the total corresponding to "before") or using the sum of the points registered for the presence of each variable that made up a given subtotal.

19. *Performance.* This is the dependent variable. Evaluation of task execution was carried out by an independent judge with a degree in teaching, but not involved in this process, using the criteria shown in Table 1.

As can be observed in this table, a two-fold performance was taken into account: cognitive and motor. *Cognitive performance* refers to an assessment of the task according to its cognitive demands. *Motor performance* refers to an assessment of the task according to its motor demands, which in this case were not the priority in correct execution of the task.

Both aspects were scored on a maximum of four points; in order to obtain the first score it was necessary to first classify the product into one of four categories, while the second score was obtained from the sum of scores obtained according to each criterion.

Finally, total performance was the arithmetic mean obtained from the two subtotal scores. Before assessing the exercises, we ensured that the judge correctly understood the established criteria. The criteria were designed from an analysis of the demands of the task, and from children's productions in earlier studies.

Table 1. Criteria for task evaluation

TOTAL PERFORMANCE = (COGNITIVE PERFORMANCE + MOTOR PERFORMANCE) / 2	
COGNITIVE PERFORMANCE	**MOTOR PERFORMANCE**
Classify each exercise into one of these categories and give it the corresponding score:	Assign each exercise one or zero points as a function of whether each criterion was met, and add up the total points:

Table 1. (Continued)

TOTAL PERFORMANCE = (COGNITIVE PERFORMANCE + MOTOR PERFORMANCE) / 2	
COGNITIVE PERFORMANCE	**MOTOR PERFORMANCE**
- Total absence of cognitive manifestations (Any apples drawn are simply colored„ and there is no evidence of counting or comparing, etc.) → *0 points* **- Comparison of the relative positions of the apples, without exactly matching the model** → *1 point* **- Comparison of the relative positions of the apples, exactly matching the model** → *3 points* **- Abstraction of the relative positions, and consideration of the total quantity of apples** → *4 points*	- Not leaving gaps (blank spaces) in the colored elements. **- Not coloring outside the lines.** - Finishing all the coloring, that is, not leaving elements uncolored. - Correctly sketching the missing apples (if done at all), including the complete detail of the leaf.
Maximum: 4 points	Maximum: 4 points

Procedure

Once the task was chosen and adapted to the students' level and the needs of this study, some prior studies were carried out in order to help refine the assessment instrument (Appendix 1). The final format of this instrument was submitted to previous evaluation by professionals working with this age group, but not connected with the present research study, that they would judge its suitability for assessing the strategies used by children in this age group; the outcome was positive.

Afterward, the two people responsible for assessing strategies were trained in use of the instrument, until they reached a degree of inter-judge reliability of greater than 85%. Both of them were from the field of Educational Psychology. Before proceeding with the individual assessment, which at all times followed the indications of the protocol-register, the two assessors visited the different classrooms, for the purpose of controlling students' possible reactivity.

When strategy assessment was completed, we selected an independent expert in early childhood work, in order to be the judge for assessing performance on the task. This person was training according to the design criteria.

Design and Data Analyses

An *ex-post-facto* design was applied, not experimental in that there was no control group. The data were subjected to statistical treatment using SPSS for Windows (version 20.0); descriptive and correlational analyses were performed. In the descriptive analyses, the presence of each directly-measured strategy (nominal strategy) was described as a percentage. We also described the mean and standard deviation of the scalar strategies, and finally, the mean and standard deviation of each of the three dimensions into which strategies were grouped after applying a factor analysis. As for the correlational analyses, we analyzed correlations between strategies used at each moment, and we created correlation matrices of the three types of performance (cognitive, motor and total) with the scalar variables and with the empirical dimensions just mentioned.

RESULTS

Descriptive Results

In general, one can see how at the first moment (before task execution), *planning* is noticeably absent (only 8.8% of pupils show signs of planning the activity). As for *awareness*, the sample seems to be divided almost equally between those who considered cognitive aspects to be central to the task (13.2%), and those who focused their attention on the motor aspects (14.7%).

At the second moment (during task execution), a low percentage of pupils showed signs of using the metacognitive strategies assessed. Thus, only 10.3% were able to explicitly state their cognitive processes, while a somewhat larger percentage, 35.3% of pupils, were able to state their motor behaviors. As for *prior organization*, just half the pupils were able to anticipate their actions; while no child stated that he or she was *reviewing* (checking their work), despite the fact that 7.4% showed signs of doing so. At the cognitive level, a high percentage of pupils *counted,* in accordance with the task objectives, while a lesser number *compared* the positions, this strategy not having been asked for specifically. Regarding support for processing, there were only isolated cases of children who referred to any type of feelings or to formulas for motivating themselves. Almost all the children *drew* round figures, and a mere 20% *colored* them.

At the third moment (after task execution), all the children rate themselves positively. Practically 30% justify this rating based on the real objectives of the task, while the percentage of those who do so based on motor aspects is only about half. However, when asked for ways to improve, this relation is inverted (10.3% compared to 14.7%, respectively). The children very rarely address metacognitive aspects, either at this moment in particular, or at any time throughout the interview. However, there are a good number of children who, when asked these questions, do not speak at all, remaining silent or speaking some random word. See Table 2.

Table 2. Percentages of the presence/absence of each of the strategies assessed directly at each moment of execution

MOMENT/STRATEGY	YES (%)	NO (%)
MOMENT 1: BEFORE		
• {0>Conciencia:<}98{>Awareness:<0}		
- {0>Centrada en aspectos motrices<}0{>Focused on motor aspects<0}	14.7	85.3
- {0>Centrada en aspectos cognitivos (centrales)<}0{>Focused on cognitive (central) aspects<0}	13.2	86.8
- {0>Aspectos metacognitivos<}0{>Metacognitive aspects<0}	0	100
• {0>Planificación<}98{>Planning<0}	8.8	91.2
{0>MOMENTO 2: DURANTE<}0{>MOMENT 2: DURING<0}		
- Cognitive		
- {0>A nivel afectivo-motivacional<}76{>Motivational-affective <0}	10.3	89.7
• {0>Estrategias metacognitivas:<}100{>Metacognitive strategies:<0} {0>Control de la ejecución:<}0{>Control of execution:<0}	35.3	64.7
- {0>Organización previa<}96{>Prior organization<0}	0	100
- {0>Revisión (con conciencia)<}0{>Reviewing (with awareness)<0}	50	50
• {0>Estrategias cognitivas:<}88{>Cognitive strategies:<0}	0	100
- {0>Contar<}0{>Counting<0}	82.4	17.6
- {0>Comparar<}87{>Comparing<0}	63.2	36.8
- {0>Preguntar<}0{>Asking<0}	25	75
- {0>Revisar<}91{>Reviewing<0}	7.4	92.6
• {0>Estrategias de apoyo al procesamiento:<}0{>Strategies to support processing:<0}	0	100
- {0>Actitudes y sentimientos positivos<}0{>Positive attitudes and feelings<0}	1.5	98.5
	0	100
	94.1	5.9

MOMENT/STRATEGY	YES (%)	NO (%)
{0>MOMENTO 3: DESPUÉS<}0{>MOMENT 3: AFTER<0}		
- {0>Actitudes y sentimientos negativos<}87{>Negative attitudes and feelings<0} - {0>Autoestimulación<}98{>Self-stimulation<0} • {0>Aspectos motrices:<}0{>Motor aspects:<0} - {0>Dibujar<}91{>Drawing<0} • {0>Colorear<}87{>Coloring<0}	19.1	80.9
• {0>Autoevaluación:<}98{>Self-assessment:<0} - {0>Bien<}95{>Good<0} - {0>Regular<}0{>So-so<0} - {0>Mal<}0{>Bad<0} • {0>Justificación:<}98{>Justification:<0} - {0>Basada en el objetivo real de la tarea<}0{>Based on the real task objective<0} - {0>Basada en aspectos motrices<}83{>Based on motor aspects<0} - {0>Aspectos metacognitivos<}100{>Metacognitive aspects<0} • {0>Posibilidades de mejora:<}0{>Ways to improve:<0} - {0>Basadas en el objetivo real de la tarea<}94{>Based on the real task objective<0} - {0>Basadas en aspectos motrices<}86{>Based on motor aspects<0} - {0>Aspectos metacognitivos<}100{>Metacognitive aspects<0}	100 0 0 29.4 14.7 4.4 10.3 14.7 5.9	0 100 100 70.6 85.3 95.6 89.7 85.3 94.1

As for the scalar variables which were constructed from the former in order to make them more operational, we were able to make the following observations:

Table 3. Descriptive statistics of the strategy totals and subtotals, according to moment and type

VARIABLE	MEAN	STANDARD DEVIATION	THEORETICAL RANGE
Total strategies at the first moment (before)	1.22	(0.51)	1-4
Total metacognitive strategies at the second moment (during)	1.95	(0.76)	1-6
Total cognitive strategies at the second moment (during)	2.79	(1.01)	1-5
Total support strategies at the second moment (during)	1	(0. 00)	1-3
Total motor strategies at the second moment (during)	2.13	(0.34)	1-3
Total strategies at the second moment (during)	4.85	(1.47)	1-14
Total metacognitive strategies at the third moment (after)	1.1	(0.35)	1-3
Total cognitive strategies at the third moment (after)	1.4	(0.67)	1-3

Table 3. (Continued)

VARIABLE	MEAN	STANDARD DEVIATION	THEORETICAL RANGE
Total motor strategies at the third moment (after)	1.29	(0.52)	1-3
Total strategies at the third moment (after)	1.79	(0.8)	1-7
Total metacognitive strategies	2.28	(1.08)	1-11
Total cognitive strategies	3.19	(1.31)	1-7
Total motor strategies	2.43	(0.70)	1-5
Total strategies	5.87	(1.92)	1-23

Source: Prepared by the authors.

One of the most noticeable aspects is the small number of total strategies used by the children, especially obvious in the metacognitive subtype. This fact is even more clearly visible in the following table, where strategies observed directly were submitted to factor analysis, and thereby grouped into three large dimensions. The mean use of strategies belonging to each of the empirical dimensions was as follows, for our sample:

Table 4. Descriptive statistics for each of the empirical dimensions. Source: Prepared by the authors

DIMENSIONS	MEAN	STANDARD DEVIATION	THEORETICAL RANGE
Metacognitive	1.59	(0.51)	1-5
Cognitive	1.95	(0.55)	1-4
Motor	1.71	(0.35)	1-3

Association Results

Correlation between Strategies Used at Different Moments

The results show that there is only one significant correlation ($p<.05$), between the total strategies used before and the total strategies used during. As for other moment comparisons of strategy use, we cannot affirm that there are any significant correlations among them, although the correlation between total strategies used before and total strategies used after is somewhat closer to significance ($p=.08$) than the correlation between total strategy use during and total strategy use after ($p=.36$). At the same time, the total strategies used at each of the three moments has a significant, strong correlation ($p<.001$) with

the strategy total. This is especially noticeable in the case of total strategies used during task execution.

Table 5. Correlations between performance on the task and strategies of each type and at each moment. The upper number in each table cell shows Spearman's rho correlation coefficient, and the lower number shows the level of significance

Variable	Motor performance	Cognitive performance	Total performance
Total strategies at the first moment (before)	0.020 .873	0.152 .216	0.119 .332
Total metacognitive strategies at the second moment (during)	0.201 .100	0.028 .818	0.087 .479
Total cognitive strategies at the second moment (during)	0.173 .159	0.427** .000	0.462** .000
Total support strategies at the second moment (during)	--- ---	--- ---	--- ---
Total motor strategies at the second moment (during)	0.386** .001	-0.066 .594	0.121 .325
Total strategies at the second moment (during)	0.306* .011	0.292* .016	0.381** .001
Total metacognitive strategies at the third moment (after)	0.080 .516	-0.051 .681	-0.016 .895
Total cognitive strategies at the third moment (after)	-0.010 .936	0.301* .013	0.241* .047
Total motor strategies at the third moment (after)	0.348** .004	-0.127 .302	0.033 .788
Total strategies at the third moment (after)	0.243* .046	0.102 .408	0.176 .151
Total metacognitive strategies	0.234 .055	0.047 .703	0.115 .350
Total cognitive strategies	0.111 .365	0.471** .000	0.461** .000
Total motor strategies	0.490** .000	-0.125 .309	0.101 .413
Total strategies	0.321** .008	0.325** .007	0.413** .000

Source: Prepared by the authors.

** The correlation is significant at the level of 0.01 (bilateral).

* The correlation is significant at the level of 0.05 (bilateral).

Correlations between Strategies and Performance

As can be seen in Table 6, the strategy total has a significant correlation (p<.01) with the three types of performance (motor, cognitive and total), slightly higher for the last two types. Furthermore, total motor strategies also

has a very significant correlation (p<.01), although this relates exclusively to motor performance. Regarding total cognitive strategies, the converse occurs; in other words, it has a correlation in the same degree (p<.01) with cognitive performance, and also has impact on total performance. Curiously, total metacognitive strategies has no significant correlation with any of the performance types assessed, even though it approaches significance with motor performance (p<.05).

If we consider the strategies applied at each moment, it is the second moment (during) that has the greatest impact on total performance, showing a very significant correlation (p<.001). It also shows less significant correlations with motor and cognitive performance. At this moment, each type of strategy clearly correlates to the analogous performance type, that is, cognitive strategies (count, compare, review, ask) correlate to cognitive and total performance (p<.001), and motor strategies (drawing, coloring) to motor performance (p<.001) – although this aspect seems quite evident. Again, at this moment, total metacognitive strategies does not in the least approach a significant relationship with performance.

Table 6. Correlations between task performance and the empirical dimensions extracted through analysis of the instrument. The upper number in each table cell shows Spearman's rho correlation coefficient, and the lower number shows the level of significance

Variable	Motor performance	Cognitive performance	Total performance
Metacognitive dimension	0.167 .174	0.051 .679	0.122 .320
Cognitive dimension	0.176 .150	0.374** .002	0.400** .001
Motor dimension	0.490** .000	-0.127 .301	0.124 .312

**The correlation is significant at the level of 0.01 (bilateral).
*The correlation is significant at the level of 0.05 (bilateral).

A similar situation also occurs at the third moment (after), when the total number of strategies showed a significant correlation only with motor performance (p<.05). Motor strategies had a very significant correlation (p=.004) with motor performance, and cognitive strategies with cognitive and total performance, although at lower levels of significance (p<.01 and p<.05, respectively). Metacognitive strategies again are just as far from any strong correlation with any of the three performance types. Contrary to the previous

cases, first-moment strategies (before) did not significantly correlate with any of the assessed types of performance.

When performing the analysis by empirical dimensions extracted from factor analysis, once again the metacognitive dimension shows no significant correlation with total performance (p=.320), or with cognitive or motor performance (p=.679 and p=.174, respectively) Previous analyses with the cognitive dimension also concur with the present case, where it is significantly associated with cognitive performance (p<.01) and with total performance (p<.001). Finally, the motor dimension confirms its degree of correlation with motor performance (p<.001).

DISCUSSION AND CONCLUSION

As predicted in the *first and second hypotheses,* the descriptive results indicate a low level of strategy use in general, and a particularly low level in metacognitive strategies. Accordingly, no more than 50% presence of any strategy was found, except for certain cognitive strategies (*counting* and *comparing*), and motor strategies (*drawing*) that were applied during task execution (second moment). In the case of metacognitive strategies (according to the empirical dimension), a meager 1.59 was obtained as the mean of usage, on a scale from 1 to 5. This data point is an unmistakable sign of how little attention is given to these matters in the early childhood classroom. Nonetheless, it is remarkable that the variable *prior organization* (included in this dimension) does reach the 50% level.

With regard to the *third hypothesis,* we note that only two moments are significantly associated with each other, the first (before) and the second (during): This interesting finding seems to suggest that the pupils who give the most forethought to the task, also use more strategies during execution. However, no other relations were found between moments. In relation to the *fourth hypothesis,* the strategies used during execution seem to be the ones most strongly associated with performance (p<.001). Perhaps we might expect some other relationship, especially between first-moment strategies (before) and performance, but this was not confirmed in this study. In relation to the *fifth hypothesis,* using both the theoretical and the empirical strategy classifications, we did not find the expected association between total metacognitive strategies and total performance. Short of this, such a relationship was found only with respect to cognitive strategies. Perhaps the

minimal differentiation at this age between cognitive and megacognitive strategies can help clarify this situation.

LIMITATIONS AND FUTURE PROSPECTS

Although we are satisfied with the contributions made, we are aware of the need to verify these contributions through replicated studies that are carried out with independent samples, and to compare the results with other results obtained using different instruments. In this process, the instruments and the assessed strategies would need to be further defined. In the case of the direct measurement of support strategies, new formulas must be studied that would contribute significant information. It would also be interesting to explore relationships between specific variables such as planning and awareness, or how variables relate to performance, such as prior organization, which has been shown to have high discriminatory power. We hope that these efforts help to spark interest in this topic from others in the academic or professional spheres.

This investigation is a look at how children learn and what strategies they use when solving a task, and caution should be used in interpreting its conclusions.

Based on this initial study, it would be interesting to look for other activities from different areas (reading/writing, science or social studies, etc.) in order to determine the generalization or specificity of the strategies that pupils use. It would also be valuable to observe whether the patterns of strategies used by particular students show certain stability over time. This aspect could be studied by repeating the experiment at different times.

Aside from all this, when all these observations have been more solidly established, we must inexorably move toward intervention in these same strategies that we have assessed. Without the hope of being able to modify strategy use, there is no use in assessing them.

We would therefore need to design corresponding intervention techniques and instruments for their implementation. A second phase would need to consist of analyzing the impact of training on strategy use and on task execution (De la Fuente, Justicia, Sander, & Cardelle-Elawar, 2014).

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APPENDIX
ASSESSMENT OBSERVATIONS

ASSESSMENT OBSERVATIONS: ADAPTATION DIALOGUE (to establish a relaxed, communicative environment)

PRESENTATION OF THE TASK AND AWARENESS

ON THIS WORKSHEET, YOU MUST MAKE ALL THE TREES HAVE THE SAME APPLES AS THE TREE IN THE BOX. DO YOU UNDERSTAND?
NOW, LOOK CAREFULLY AT THE WORKSHEET, AND TELL ME: WHAT DO YOU THINK IS MOST IMPORTANT?, WHAT DO I WANT YOU TO LEARN FROM THIS?

I don't know / Remains silent or focuses the objective on extraneous aspects	Motor aspects: *drawing, coloring, not going out of the lines*	← Thinking, observing, etc. →	Central aspects: *counting, comparing, the numbers, etc.*

Very good. Now, while you're doing the worksheet, we're going to play the microphone game, do you know how it goes?
You have to say aloud everything that you're doing and thinking while you do the worksheet. For example: Now I'm thinking about what I'm going to do, now I am drawing an apple ..., OK? So, you can start as soon as you want, and don't forget to say into the microphone what you are doing and what you are thinking.

PLANNING

I am thinking, I am looking, I am seeing what I have to do first, etc.	Nothing that directly indicates planning

METACOGNITIVE STRATEGIES					**COGNITIVE STRATEGIES** (counting, comparing, etc., but not saying so)		**SUPPORT STRATEGIES**			MOTOR AS PECTS (Drawing, coloring, etc., but not saying so)	
KNOWING ABOUT ONE'S KNOWLEDGE (SAYS WHAT HE/SHE IS THINKING OR DOING. E.G. *I AM THINKING THAT I HAVE TO COLOR, I AM COUNTING, ETC.*)			***CONTROL OF TASK EXECUTION***				**ATTITUDES AND FEELINGS** (e.g. *I am tired, I like the worksheet, etc.*)		**SELF-STIMULATION** (e.g. I'm almost done!)		
			PRIOR ORGANIZATION (Says before doing: *now I'm going to ...*)	**REVIEWING** (Says that he/she is checking it over)							
Cognitive	**Motor**	**Support**			Counting	Comparing	+	-		*Drawing*	Coloring
					Asking	Reviewing					

SELF-ASSESSMENT		
How do you think it turned out?		
Good	So-so	Bad
Why?		
Justification based on the real objective of the task (e.g. *I counted, I compared …*)	← Because I thought, I looked at... →	Justification based on motor aspects (e.g. *I didn't color out of the lines, I didn't leave blank spaces, etc.*)
What would you do next time to make it turn out even better?		
Cognitive aspects in line with the task	← Think more, look at it more … →	Motor aspects